Claims

1. A fuel cell stack having:

a plurality of fuel cells disposed between current-collecting end plates; and

at least one reactant gas manifold;

characterized by the improvement comprising:

each said at least one reactant gas manifold comprising either (a) a single wall, with a VIP or GFP disposed inside or outside said single wall, or (b) a double wall forming a chamber, said chamber containing a vacuum, a low thermal conductivity gas, a VIP or a GDF; and

an insulator panel disposed on an external surface of each of said end plates, each insulator panel comprising either (a) a hollow chamber containing a vacuum or a low thermal conductivity gas, or (b) a VIP, or (c) a GFP.

2. A fuel cell stack according to claim 1 wherein:

said fuel cell stack has a plurality of said reactant gas manifolds and porous water transport plates serving as reactant gas flow fields; and

said manifolds and said insulator panels are selected in correspondence with the mass times heat capacity, external surface area and water inventory of said fuel cell stack so that the water in said stack is not totally frozen when said fuel cell stack is inoperative in an ambient environment for greater than fifty minus-degree-days.

3. A fuel cell stack according to claim 1 wherein:

said fuel cell stack has a plurality of said reactant gas manifolds and porous water transport plates serving as reactant gas flow fields; and

said manifolds and said insulator panels are selected in correspondence with the mass times heat capacity, external surface area and water inventory of said fuel cell stack so that the water in said stack is not totally frozen when said fuel cell stack is inoperative in an ambient environment for about 100 minus-degree-days.

4. A fuel cell stack according to claim 1 wherein:

said fuel cell stack has a plurality of said reactant gas manifolds and porous water transport plates serving as reactant gas flow fields; and

said manifolds and said insulator panels are selected in correspondence with the mass times heat capacity, external surface area and water inventory of said fuel cell stack so that the water in said stack is not totally frozen when said fuel cell stack is inoperative in an ambient environment for about 150 minus-degree-days.

5. A fuel cell stack comprising:

a plurality of fuel cells disposed between current-collecting end plates; and

an insulator panel disposed on an external surface of each of said end plates, each insulator panel comprising either (a) a hollow chamber containing a vacuum or a low thermal conductivity gas, or (b) a VIP, or (c) a GFP.

6. A fuel cell stack according to claim 5 wherein said insulator panels comprise either (a) a VIP or (b) a GFP with an external film of (c) plastic or (d) resin/fiberglass composite for enhanced structural integrity.

7. An insulated reactant gas manifold for a fuel cell stack comprising either (a) a single wall, with a VIP or GFP disposed inside or outside said single wall, or (b) a double wall forming a chamber, said chamber containing a vacuum, a low thermal conductivity gas, a VIP or a GDF.

8. A manifold according to claim 7 wherein said double wall forming a chamber comprises a layer of either (c) plastic or (d) resin/fiberglass composite on the surfaces of (e) a VIP or (f) a GFP for enhanced structural integrity.